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DETERMINATION OF PERMISSIBLE OVERLOADS ON DISTRIBUTION TRANSFORMERS

by

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SUMMARY

This bulletin contains:

1. A method of determining permissible overloads on existing distribution transformer installations.

2. A method of determining the proper size of transformer to be used when peak load and normal load are known.

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CHART I

PERMISSIBLE OVERLOADS ON DISTRIBUTION TRANSFORMERS

This chart shows the ratio of allowable peak load to rated transformer capacity for varying periods of overload. It is to be used where the allowable overload on an existing installation is to be determined. The chart is not for use with Completely Self Protecting (CSP) Type Transformers equipped with thermal breakers.

1. For overloads up to 5 minutes duration use Curve A.

2. For intermittent overloads of durations from 5 minutes to 8 hours, following a period of no initial load, use Curve B.

3. For intermittent overloads of duration from 5 minutes to 8 hours, following varying initial load conditions, use Curves C, D, E, or F.

To determine initial load conditions:

1. Take the average over a period of 12 hours preceding the peak load.

2. In cases where the peak load occurs at intervals of less than 12 hours, take the average of the loads between peaks.

Example:

Assume a 100-kva transformer bank. It is required to find the percentage of peak overload permissible for a period of 3 hours assuming that the peak follows an initial normal load of 60% rated capacity.

1. Use Curve D for 60% initial load.

2. Against a duration of peak of 3 hours, a peak load of 115% is permissible. 100 x 1.15 = 115 kva is the permissible load on the bank, provided the average daily ambient temperature is 30° C. For other ambient temperatures refer to Chart II for correction factor.

Chart 1

PERMISSIBLE OVERLOADS ON DISTRIBUTION TRANSFORMERS

REPRODUCED FROM A.I.E.E. TECHNICAL PAPER 39-171

FOR 30° AMBIENT TEMPERATURE

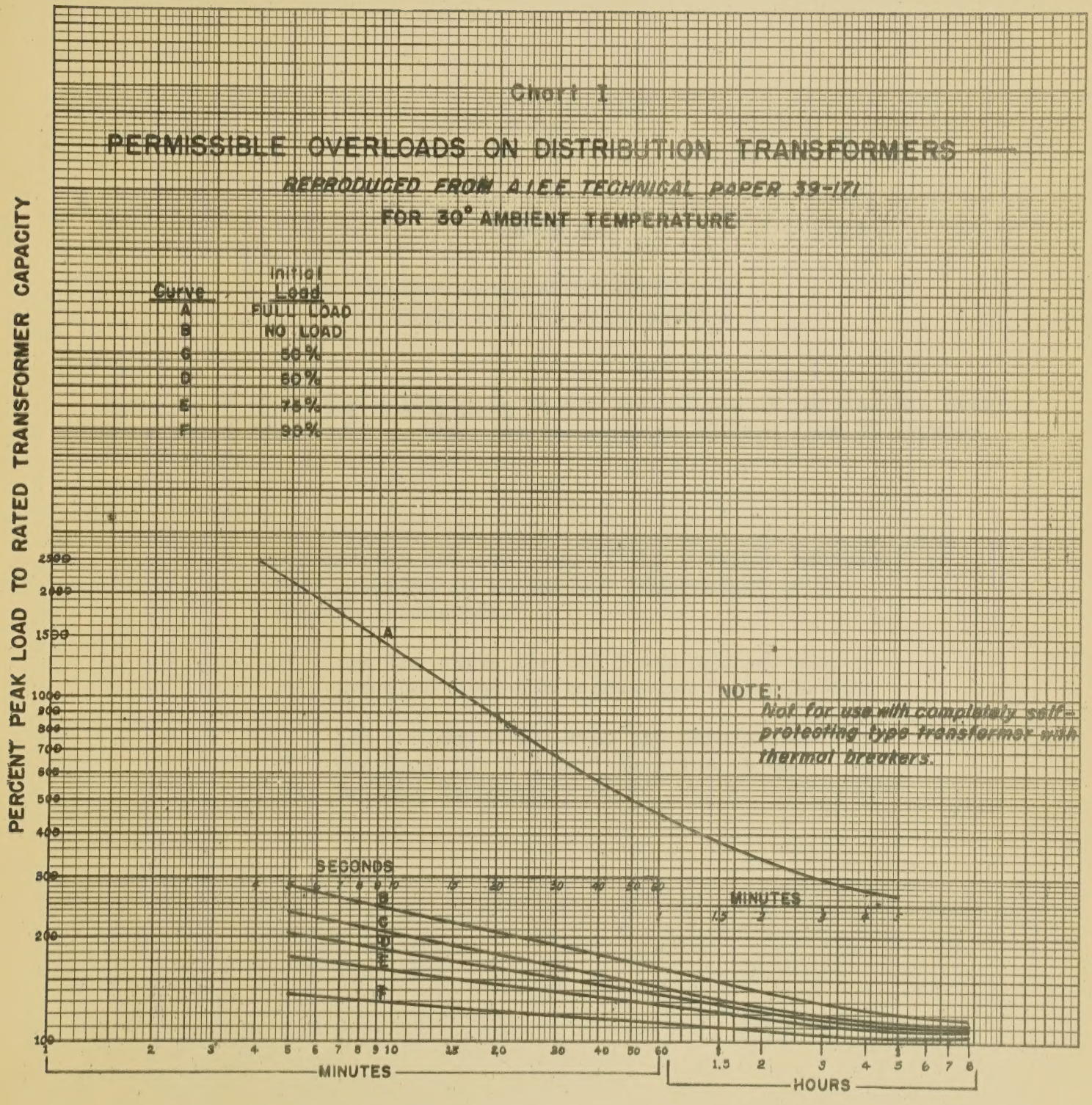


CHART II

AMBIENT TEMPERATURE CORRECTION FACTORS FOR USE WITH CHART I

This chart gives the multiplying factor for values of permissible overload found from Chart I, when the temperature differs from 30 degrees Centigrade.

Example:

Suppose the 100-kva bank of the previous example were operated in an ambient temperature of 20 degrees Centigrade.

Use the curve for 20° C and against 115% overload find the correction factor 1.085.

115 x 1.085 = 125 kva, the permissible overload for 3 hours' duration at an ambient temperature of 20° C.

Chart II

AMBIENT TEMPERATURE CORRECTION FACTORS

TO BE USED WITH CHART I FOR AMBIENT TEMPERATURES OTHER THAN 30°C.

COMPILED FROM A.S.A. RECOMMENDATIONS AS FOLLOWS:—

1. *For each degree C. that the average ambient air temperature is below 30°C. allow an increase in load of 1%.*
2. *For each degree C. that the average ambient air temperature is above 30°C. decrease the load 2%.*
3. *These considerations apply only to ambient temperatures between 0°C. and 50°C.*

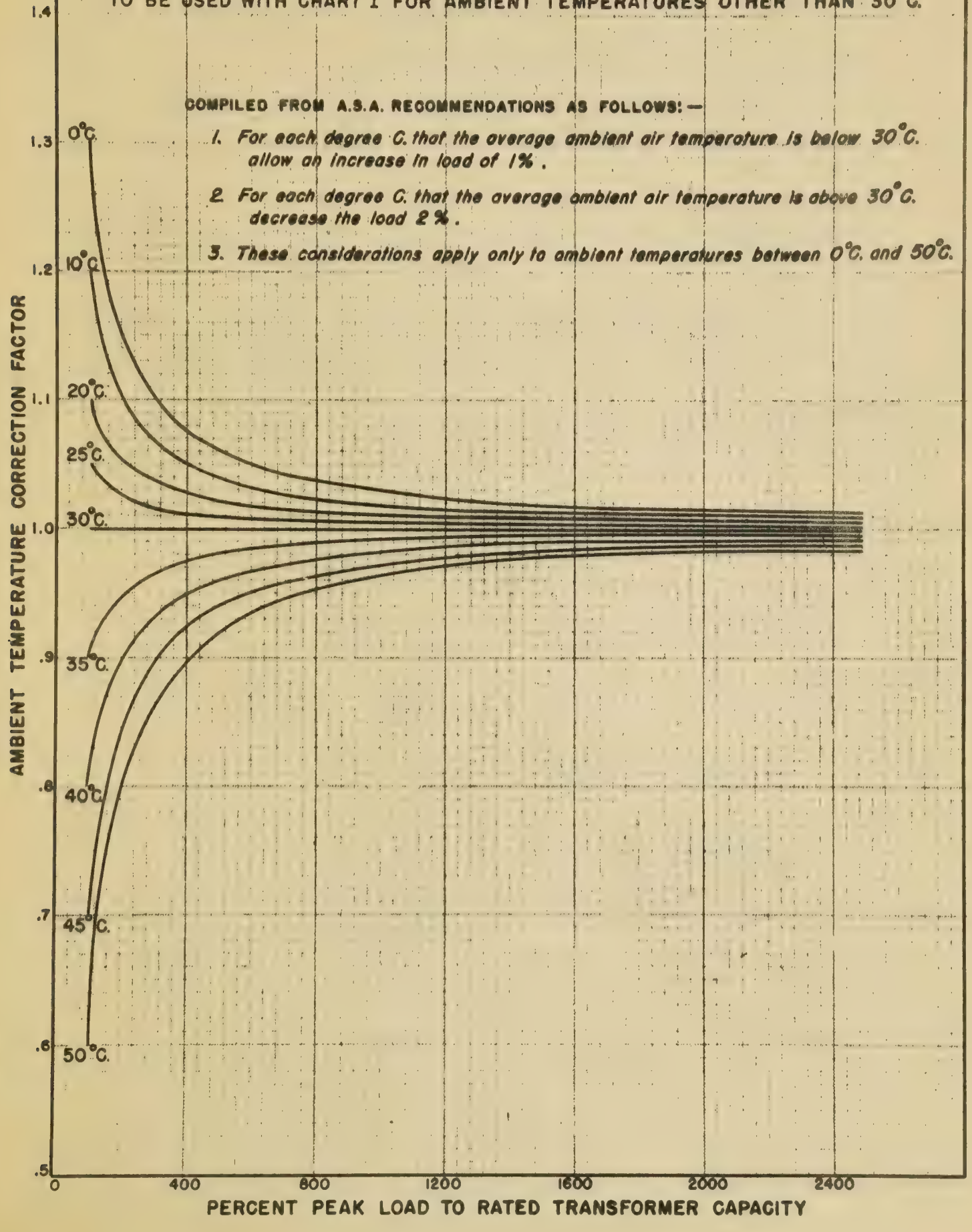


CHART III

TRANSFORMER RATING FACTOR
as a
Function of Equivalent Rectangular Peak Duration and Equivalent Initial Load

This chart is to be used to determine the size of transformer required for an installation when the peak and normal load requirements and the duration of peak load are known.

The chart gives a Transformer Rating Factor, which, multiplied by the peak load, gives the required transformer rating for 30 degrees Centigrade ambient temperature.

The normal load is determined in the same manner as the initial load conditions for Chart I. This chart is not for use with CSP Type transformers equipped with thermal breakers.

Example:

Assume a peak load of 200 kva lasting 3 hours with a normal load of 100 kva.

1. Express the normal load as a percentage of peak load:

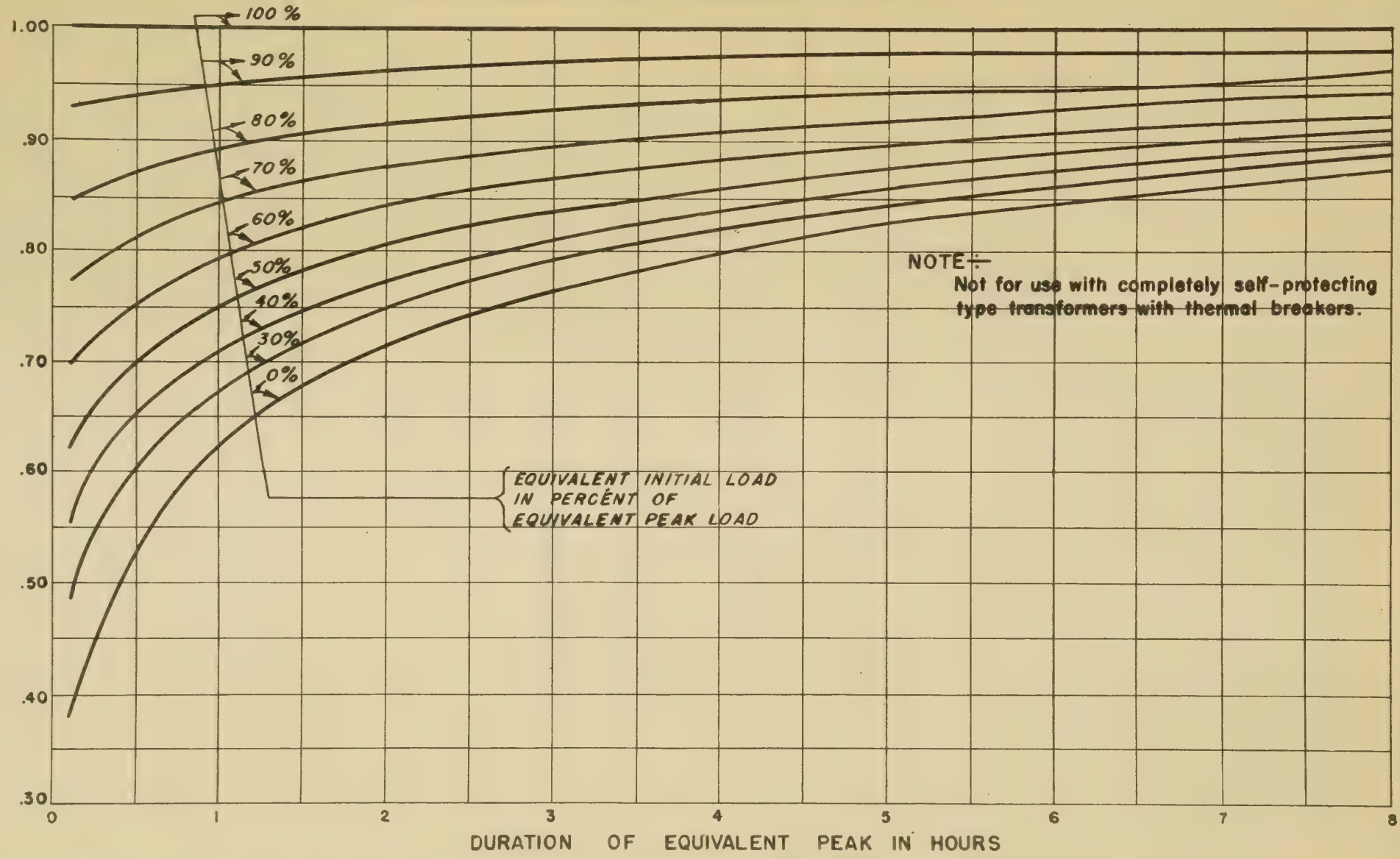
$$\frac{100}{200} = 0.5 = 50\%$$

2. Use the curve for 50%. Opposite 3 hours' duration of peak find a transformer rating factor of 0.84.

   0.84 x 200 = 168 kva required transformer capacity for an ambient temperature of 30 degrees Centigrade. For other ambient temperatures refer to Chart IV for correction factors.

Chart III

TRANSFORMER RATING FACTOR AS A FUNCTION OF EQUIVALENT RECTANGULAR PEAK DURATION AND EQUIVALENT INITIAL LOAD



REPRODUCED FROM ARTICLE APPEARING IN FEBRUARY ISSUE OF THE GENERAL ELECTRIC REVIEW BY P.L. ALGER, ENTITLED "PROGRESS IN ENGINEERING KNOWLEDGE DURING 1939."

CHART IV

AMBIENT TEMPERATURE CORRECTION FACTORS FOR USE WITH CHART III

This chart gives the multiplying factor for values found in Chart III, for ambient temperatures other than 30 degrees Centigrade.

Example:

Assume the case of the previous example where the ambient temperature is 20 degrees Centigrade.

1. Use 20° C curve. Against a transformer rating factor of 0.84 find a correction factor of 0.92.

   168 x 0.92 = 155 kva required transformer capacity.

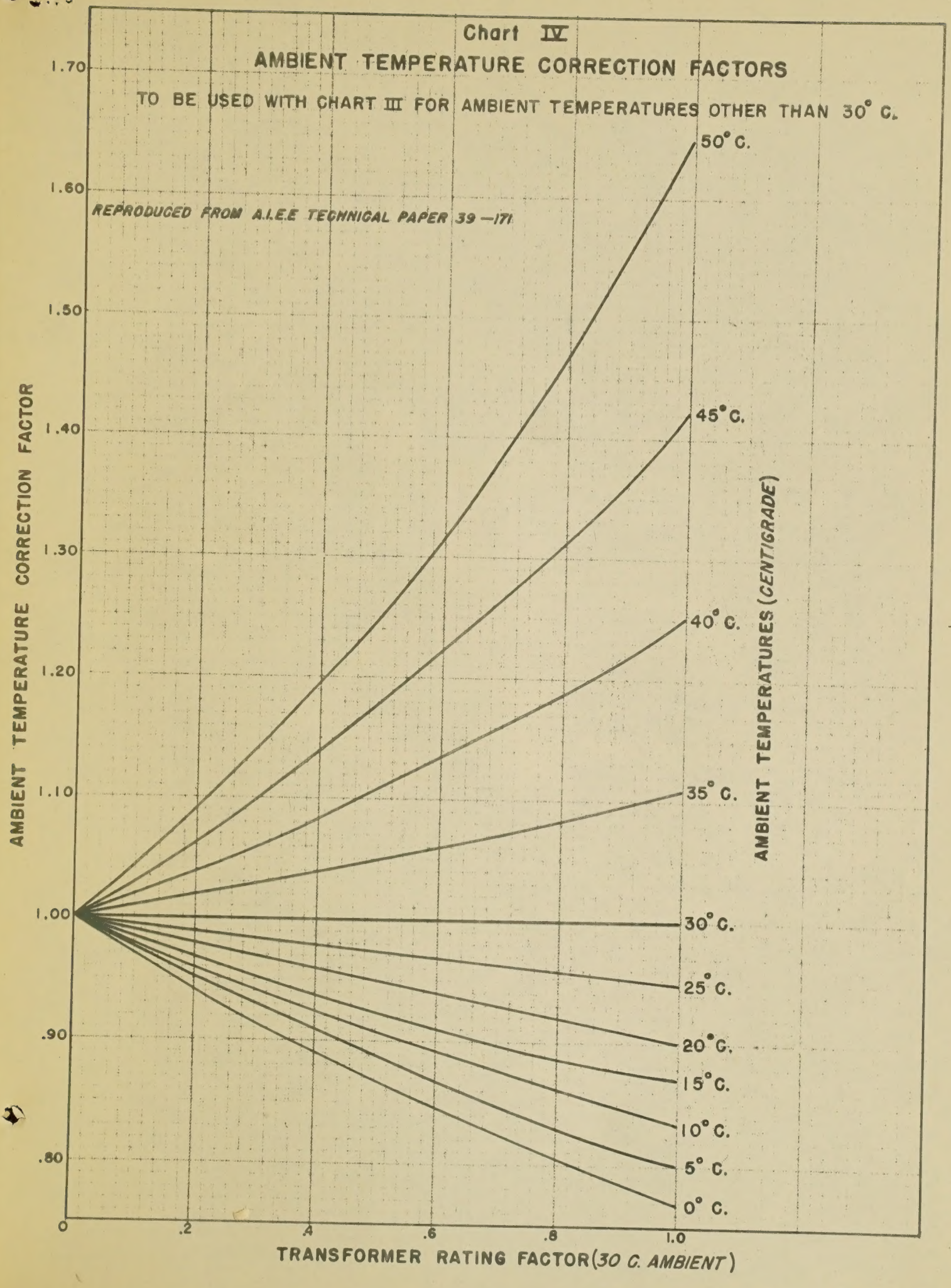
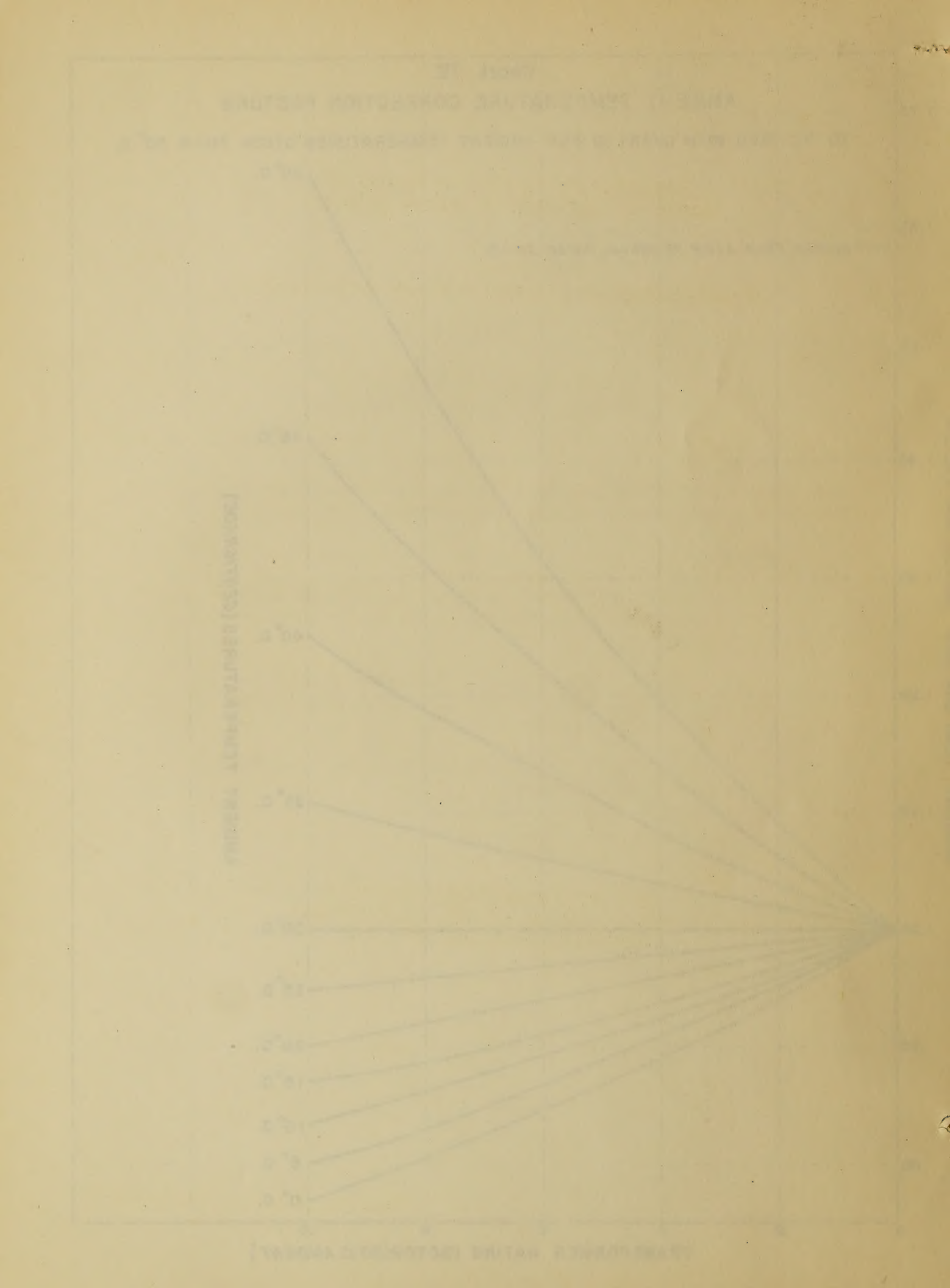


Chart IV
AMBIENT TEMPERATURE CORRECTION FACTORS
TO BE USED WITH CHART III FOR AMBIENT TEMPERATURES OTHER THAN 30° C.
REPRODUCED FROM A.I.E.E TECHNICAL PAPER 39—171
AMBIENT TEMPERATURE CORRECTION FACTOR
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.90
.80
0
.2
.4
.6
.8
1.0
TRANSFORMER RATING FACTOR (30 C. AMBIENT)
AMBIENT TEMPERATURES (CENTIGRADE)
50° C.
45° C.
40° C.
35° C.
30° C.
25° C.
20° C.
15° C.
10° C.
5° C.
0° C.